

## DRIVE ARRANGEMENT WITH A FIXED BEARING CROSS REFERENCE TO RELATED APPLICATIONS

- 5 [0001] This application is filed under 35 U.S.C §120 and §365(c) as a continuation of International Patent Application PCT/DE03/01186, filed April 10, 2003, which application is incorporated herein by reference. This application also claims priority of German Patent Application Nos. filed 102 15 715.4 filed April 10, 2002, and 102 41 068.2 filed September 5, 2002, which applications are incorporated herein by reference.

## BACKGROUND OF THE INVENTION

- [0002] The present invention relates to a motor arrangement having a unit comprising stator and rotor that can be mounted in a motor housing and having a rotor shaft mounted in a fixed bearing.

- [0003] Typically, in known motor arrangements the fixed bearing is mounted on the side  
15 of the shaft output of the motor.

## OBJECTS OF THE INVENTION

- [0004]** The object of the present invention is to improve the performance of such a motor when there are vibrating stresses.

## BRIEF SUMMARY OF THE INVENTION

- 20 [0005] This objective is achieved via a motor arrangement in which an injection-molded part is provided comprising a plug part on an outer annular part that has a branch supply line connected to the coil of the stator and a sensor line connected to the sensor circuit board, the circuit board having at least one sensor. The injection-molded part further comprises an inner annular part in which the fixed bearing is mounted on the side axially opposed to the shaft output  
25 of the motor arrangement.

- [0006] The important advantage of the present invention is that, because of the arrangement of the fixed bearing on the side axially opposed to the motor, the center of gravity of the present motor arrangement can be displaced further in the direction of the screw-on surface of the motor housing, whereupon the performance of the motor arrangement according to the invention in response to vibration stresses is improved. The fixed bearing in this context may

preferably be mounted in a bearing holding part of the inner annular part or be supported against it.

[0007] In a preferred embodiment of the invention, the sensor circuit board is fixed to the inner annular part. However, it may also be held by the sensor line that is fixed in the outer 5 annular part. The sensor circuit board preferably also has an electric component that works together with the sensor.

[0008] The branch supply line and the sensor line are expediently produced in the form of a pressed screen, the areas of the lines leading to the sensor circuit board or the stator leading to the sensor circuit board are fixed or embedded in the outer annular part. During the production 10 of the motor arrangement, the lines connected to each other via an exterior jumper part in the pressed screen can be disconnected from each other during the production of the motor arrangement by removing the jumper part at an appropriate moment.

[0009] Between the outer annular part and the inner annular part of the injection-molded part, there exists essentially one channel in which the ends of the branch supply line and the 15 sensor line are accessible along with the stator coil or the sensor circuit board before introduction of a molding compound. In this way, the electrical connections between the sensor circuit board and the sensor line as well as between the stator coil and the branch supply line can easily be produced because of the good accessibility.

[0010] The plug part or its body is integrally molded on the perimeter of the outer annular 20 part, areas of the branch supply line and the sensor line being embedded in the body of the plug part. This results in an especially good fixation of the aforementioned lines. In an especially preferred embodiment of the invention, seals for the tight fitting of the motor housing and/or the tight fitting of a covering part, which are annular on the inside when viewed radially, are disposed, preferably integrally molded on the body of the plug part.

[0011] The fixed bearing is fixed by a fixation part supported at the inner annular part. The side of the stator facing the plug part preferably engages in a receiving opening of the body 25 of the plug part. The intermediate space between the outer and inner annular parts, the areas of the branch supply line arranged therein and the sensor line, as well as possibly the fixation part and the stator, are molded by a molding compound into a unit and fixed to each other. An especially stable unit is produced if the molding compound also surrounds and fixes the outer

side and the side of the stator that faces away from the plug part. The rotor along with the shaft and a floating bearing mounted thereon on the side facing away from the plug part are installed in the stator in such a manner that the area of the shaft passing through the fixed bearing is preferably attached on the outer side via shoulders. The floating bearing may likewise be attached  
5 to the shaft via shoulders. In one production step, the motor housing is axially pushed onto the stator and the floating bearing and placed against the body of the plug part and fixed to it. In this context it is advantageous that the force at work here is guided via the stator block. Especially advantageously, an attachment area of a cover part mounted from the fixed bearing side overlaps the end of the motor housing that faces the cover part. In this way, the motor housing and the  
10 cover part, on the one hand, are attached to each other and, on the other hand, are also attached to the unit of the motor arrangement.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The motor arrangement of the present invention and its embodiments are explained in detail below in connection with the figures. In the drawing:

15 Figure 1 shows a pressed screen and sensor circuit board of the motor arrangement of the invention;

Figure 2 shows the plug part of the motor arrangement of the invention;

Figure 3 shows the stator block of the motor arrangement of the invention;

Figure 4 shows the stator block of Figure 3 in the molded state;

20 Figure 5 shows the insertion of the rotor assembly group in the motor arrangement of the invention;

Figure 6 shows the mounting of the motor housing on the arrangement of Figure 5; and,

Figure 7 shows the finished motor arrangement of the invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

25 [0013] According to Figure 1, a so-called pressed screen of the aforementioned motor arrangement comprises a sensor line 2 and branch supply line 3 that are connected to each other via the jumper part 4 (dashed line), which may be detached later at an appropriate point in time. The sensor line 2 and the branch supply line 3 are fixed in an injection-molded part 5, which is preferably configured in the shape of a ring and has an outer annular part 5-1 and an inner

annular part **5-2**. The aforementioned lines **2**, **3** are preferably partially embedded in outer annular part **5-1**.

[0014] Pins **6**, which hold a sensor circuit board **7** and preferably are thermoformed for the attachment of sensor circuit board **7**, are preferably mounted on inner annular part **5-2** of the injection-molded part **5**. Sensor circuit board **7** may also be accommodated or held by pressed screen **3**. It is connected to pressed screen **3** in an electrically conductive manner via an axial channel **9** by an addition of heat. Pressed screen **3** may be separated by detachment of the jumper part **4** in individual lines **2** and **3**. Sensor circuit board **7**, which comprises a sensor (not described in detail) and preferably also electronics, may be electrically tested after detachment of jumper part **4**. Injection-molded part **5** then holds pressed screen **3** and sensor circuit board **7**, and it preferably includes bearing surfaces of a bearing holding part **8** for fixed bearing **14** of the motor arrangement.

[0015] In an alternative embodiment, inner annular part **5-2** of injection-molded part **5** has no bearing holding part. The fixed bearing is axially braced in this case directly against bearing surface **1** of inner annular part **5-2**.

[0016] Injection-molded part **5** has at least one channel **9** that preferably extends in the axial direction to both sides and opens and through which runs the end region of branch supply line **3** that is arranged within injection-molded part **5** for later contacting. Also, the end of sensor line **2** is accessible in channel **9** for contacting.

[0017] According to Figure 2 plug part **10** is integrally molded on injection-molded part **5**, more precisely on outer annular part **51** of said injection-molded part. Plug part **10** comprises all functions of the plug part and also holds the injection-molded part along with pressed screen **1** or lines **2**, **3** and sensor circuit boards. Moreover, plug part **10** also has radial contours for later accommodation or mounting and connection to a motor housing **25** (Figure 6). Seals **11**, **12**, which enable a tight connection to motor housing **25** and a cover part **26** (as will be explained later), can be arranged, preferably integrally molded, on plug part **10** on both sides of plug part **10**. In the arrangement of seals **11**, **12**, one must make sure that they completely define the sealing surfaces on the body of plug part **10** in order to prevent an infiltration between plug part **10** and injection-molded part **5**. The maximum permissible temperatures for sensor circuit boards **7** and their connections must be observed during the injection of plug part **10**.

[0018] According to Figures 3 and 4, stator **13**, plug part **10**, fixed bearing **14** and bearing mount **15** are situated below via an apparatus. Coil branch **16** and sensor circuit board **7** are electrically conductively connected to the branch supply line **2** or sensor line **3**. Axial channels **9** of injection-molded part **5** provide the suitable space for this. The apparatus for placement 5 provides the possibility for aligning the sensors with the coils. This occurs with a magnet **30** defined for stator **13** (Figure 5). In this way an optimized commutation signal and, thus, a better motor utilization is achieved. For the alignment, the stator coils and sensors might also be contacted via plug part **10** and the alignment achieved via the created fields. A mechanical assignment of coil to sensor via the apparatus is possible. Fixed bearing **14** and then its fixation 10 part **15** are inserted into inner annular part **5-2**, which is connected to plug part **10**. They are axially held (possibly with pre-tensioning).

[0019] According to Figure 4, the coil form of stator **13**, together with plug part **10** and inserted fixed bearing **14**, along with its fixation part **15**, are molded into one unit using a suitable molding compound **20**. In this way, the complete sealing of the geometries is achieved. 15 Stator **13** is axially and radially sealed in order to fix the cylinder mold and the windings. Molded mass **20** also encloses sensor circuit board **7** together with its electronic components (sensors and electronics) one. Fixed bearing **14** is held between injection-molded part **5** (or plug part **10**) and fixation part **15**. The molded parts preferably each have undercuts in order to ensure a form fitting with molded mass **20**. One must pay attention to the material of molding compound **20** 20 and its compatibility with the other materials and surfaces. With thermoset plastics, one must watch out, for example, for the gas evolution and etching of the circuit boards as well as the sealants and materials. With thermoplastics one must pay attention to the temperature compatibility of the individual components and with plastics to lagging and shrinkage behavior in general. The unit produced in this way may also be used without an additional motor housing. 25 It can be pushed into an electric motor housing or, for example, a transmission housing.

[0020] According to Figure 5, the assembly group comprising rotor **21** and motor shaft **22** is then mounted together with an added floating bearing **23** for the floating bearing point, spacer ring, magnet packet and control magnet **30** aligned therewith. In the process, motor shaft **22** is inserted in fixed bearing **14** and, as is evident, preferably firmly buttressed.

30 [0021] The unit that then exists may be tested without a motor housing in an apparatus.

[0022] According to Figure 6, the aforementioned unit may be used in an associated motor housing 25 to construct a drive pinion or in a suitable screw-down geometry. When the stator is pressed into motor housing 25, the force runs through the stator block.

[0023] The shaft seal, flange gasket 33 and gasket 11 between stator block and motor 5 housing 25 may be applied, for example, vulcanized on motor housing 25.

[0024] Figure 7 shows the motor arrangement that is screwed into different planes with screw-down parts 27. The cover part 26 engages behind motor housing 25 with an attachment area 28 that preferably runs axially through the body of plug part 10 or is squeezed against it.

[0025] The patent claims submitted with the application are proposed formulations 10 without prejudice to the achievement of further patent protection. The applicant reserves the right to submit claims for further combinations of features previously only disclosed in the description and/or the drawings.

[0026] References used in the dependent claims refer to the further development of the subject matter of the principal claim via the features of the particular dependent claim, they are 15 not to be understood as a renunciation of achieving independent protection for the combination of features for the dependent claims that are referenced.

[0027] Since the subject matter of the dependent claims may constitute separate and independent inventions in relation to the state of the art on the priority date, the applicant reserves the right to make them the subject matter of independent claims or division declarations. 20 Furthermore, they may also contain independent inventions that have a design that is independent of the subject matter of the preceding dependent claims.

[0028] The embodiments are not to be understood as a restriction of the invention. Rather, numerous amendments and modifications are possible within the context of the current disclosure, especially those variants, elements and combinations and/or materials that one skilled 25 in the art may learn, for example, by combining individual ones together with those in the general description and embodiments in addition to features and/or elements or methodological steps described in the claims and contained in the drawings with the aim of achieving the objective and leading to a new subject matter or new methodological steps or sequences of steps via combinable features, even as far as production, testing and work procedures are concerned.

